of entering very small spaces. I have never captured the adults nor found the larvae in the field, either at the Coast or in the Dry Belt.

Mr. W. J. Brown of Ottawa very kindly named the species for me and referred me to Milliron's description of it (in the Annals of the Ent. Soc. of America, **32** (3): 570-574, fig. 1. September, 1939.) In this article, Dr. H. E. Milliron of University Farm, St. Paul, Minnesota, describes it as a new species, reared in 1938 from a 20 to 25 year old demonstration wasp nest—hence the specific name *vespulae*. The only previous record of it in Minnesota was a pinned specimen in the University museum labelled "University farm campus, September 10, 1934."

I submitted a specimen to the late Mr. Ralph Hopping shortly after finding the first adult and he told me it was a *Perimegatoma* but could not name it to species.

Notwithstanding my most strenuous efforts at control, the pest is still very much with us and is constantly cropping up in the collections. Milliron found the species to be parthenogentic which would account for its prevalence all over our storerooms and its success in becoming established.

Finally, in this catalogle of stray or purposive invaders of dwellings in this area, may be mentioned outbreaks that have occurred several times in the late autumn, of vast numbers of minute pale brown beetles that swarm in basements, appearing suddenly on basement windows in such numbers as to practically shut out the light. They apparently breed on and emerge from wood that is stored for fire places, chiefly alder and coast maple. A series from one house, (November, 1933) yielded the following list (identified by Mr. H. B. Leech):—

Nitidulidae	*Epuraea* spp.
	Another genus
Cryptophagidae	*Atomaria* sp.
	2 other genera
Lathridiidae	*Coninomus constrictus* Gyll.
	Coninomus nodifer Westw.

Acknowledgments—I am deeply indebted to the following specialists who have named specimens for me over a number of years: Mr. W. J. Brown, Division of Entomology, Ottawa, Ont.; the late Ralph Hopping, and Mr. H. B. Leech, of the Dominion Entomological Laboratory, Vernon, B.C.

THE RESULTS OF FURTHER WORK DONE ON THE CONTROL OF GRAIN MITES IN BRITISH COLUMBIA*

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The need for conserving products vital to the well being of the British Empire and her allies is being continually stressed by our Governments. Food in all forms comes under the category of vital commodities to such an extent that at the present time some of these products are rationed, not that there is a shortage, but so that an adequate supply will always be available. Steps to conserve food products from deterioration due to insects have been taken by the Department of Agriculture from the beginning of hostilities, and the Division of Plant Protection has assisted other branches of the Service in this work. All elevators, mills, and warehouses where large stocks of grains and cereals are stored have been periodically inspected. During the past season it has been our privilege to assist Mr. Harold Gray, who is in charge of the Stored Product Insect Investigation Division and Dr. Beverley N. Smallman of the Board of Grain Commissioners for Canada,

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who have been carrying on extensive work in the control of these stored product pests.

Mites may be found in practically any grain, and under normal conditions are not serious, but the lack of shipping has created a problem. Recently, we have had to put a large percentage of our crops in temporary storages, where turning the grain is an additional cost. Added to this, last year's harvesting weather was very poor and we have to consider a certain amount of tough or damp grain. Stored tough grains or grain where the moisture content is above normal, must be turned at regular intervals to avoid heating. Wherever the moisture content rises above fourteen percent we may expect a heavy infestation, unless the grain is stored in separate bins and turned at regular intervals.

In a well operated elevator the bins are numbered, or should be. If, for example, bins Nos. 3, 5 and 8 have a high moisture content in the grain, there is also a slight increase in the temperature. In a routine inspection the investigator should pay particular attention to these two points and draw samples from these bins first. If a bin is infested, samples should be drawn from both the top and the bottom. Where infestations are slight quite often the mites will be found only in the first few feet of the grain on the top of the bin and for a few feet up from the bottom. Usually grain in such bins will register a normal moisture content. Bottom samples should be drawn until there is no further evidence of infestation. Inspectors who are conversant with this work will have little or no difficulty in detecting the presence of mites since they give off a sickly sweet odour. If this odour is strong the infestation undoubtedly is heavy. Dr. Smallman stated that if the top of the bin were infested, the action of emptying it would not necessarily correct this, if the grain was simply drawn off that bin and placed in another. In drawing off the grain, that on the top of the bin settled down to about thirty or forty feet from the bottom before it coned in, and the mites on the top portion would then be deposited on the top of the new bin. To test this, I tied an eight-pound weight to a long rope, and buried it about two feet in the top surface of the wheat in a bin 26 feet wide and 100 feet deep. The bottom gate was then opened; the bin took 2½ hours to empty. Samples were drawn at intervals and showed mites in the bottom few tons and freedom from mites above that until the bin started to cone in. It was not until the grain had settled to within forty feet of the bottom that it coned in and the weight began to pull. This meant that the mites simply settled down as Dr. Smallman had stated, and would be deposited on the top of the next bin, unless that last thirty or forty tons were put over the cleaners. Re-examination of the wheat in the top of this new bin showed a decrease in the number of mites, indicating that some had perished in the transfer of the wheat, but there was still a nucleus to build up the infestation should other conditions become favourable. It is therefore suggested that where conditions of this nature exist, the wheat from the bottom and top of the bin should be put over the cleaners and driers.

Fumigation of elevators has always been a problem; it is difficult to get a gas that will penetrate through the mass of wheat and be effective in the control of mites. Some experiments have been made with chloropicrin and methyl bromide. Chloropicrin may be used under very low temperatures and at any place where the bin walls and floors are reasonably tight. A disadvantage is that this gas will not penetrate more than twenty-five or thirty feet within a thirty-six hour exposure, and so in large bins can be used only for surface fumigation. An experiment was tried out last season by Dr. Stillman: In one of our elevators he fumigated a large bin with methyl

bromide, using one pound of this gas to each thousand cubic feet. The gas penetrated through ninety feet of grain in a thirty-six hour exposure, giving a very satisfactory control of the mites.

In the use of gases, certain points must be remembered. (1) Will the gas be effective? (2) Is the cost of application economically such as to be recommended for commercial uses? (3) Will there be any possibility of tainting? And (4) is it a safe gas to recommend?

(1) We know that methyl bromide is a heavy gas and under certain temperatures it will penetrate through grains to a great depth. We should note that grains which have been placed in bins during the summer months and are under normal storage conditions, do not change in temperature more than two or three degrees Fahrenheit. That is to say, grain with a temperature of around 55° to 60° F. when placed in the bin, would retain that temperature throughout the year. Grains which have been placed in a bin during the winter months and which may have been exposed to low temperatures in transit, might register as low as 30° to 35° F., which would be too low for fumigation with methyl bromide. Optimum temperature for the use of methyl bromide is around 65° F., but this gas may be used at slightly lower temperatures with good results.

(2) At the present time, the cost of methyl bromide makes the cost of application rather high. Used at the rate of two pounds per 1000 cubic feet in a bin say 26 feet wide by 100 feet deep, would cost approximately $100 and it might be cheaper to run that bin over the driers.

(3) The question of tainting food products must always be considered. Dr. H. C. Dudley of the United States National Institute of Health, Washington, D.C., has been working for several years on the problem of methyl bromide residues and in connection with this matter he has this to say: "In general fresh fruits and vegetables, dried fruits and whole grains absorb but minor amounts of the fumigant. Milled grains and fatty or oily foods absorb a great amount of methyl bromide." Dr. Dudley's tests were made from grains which had been fumigated with two pounds of methyl bromide per 1000 cu. ft. Thus from a residue standpoint, methyl bromide may be used with safety in fumigating whole grains.

(4) The question of the gas being a safe one to recommend has also been studied. Methyl bromide is now being used for the control of pests both of stored products and of green vegetables, and where it is carefully handled there should be no danger in its use. It must be pointed out, however, that the gas is practically colourless and odourless. This constitutes a real danger where it might get into the basement of a large elevator, and the basement not be properly ventilated. It is always best to use a gas mask where ventilation is poor, and the operator should see that the mask fits properly and that the canister used is suitable for that type of gas. Before entering a fumigated building a Halide light detector should be used to detect the presence of methyl bromide. If the gas is present the flame will turn from a purple to a purplish blue, and if the concentration is fairly heavy, the flame will turn entirely blue. There is also one other point that must be thoroughly understood: before entering the basement of any building, particularly if the basement has been closed for some time, the whole building should be opened up and well aired, since it would be unsafe to wear a gas mask if the oxygen content of the air in that basement were low.

Methyl formate has been used in conjunction with carbon dioxide and sold under the trade name of "Proxate", and later methyl bromide was used with carbon dioxide. The idea of the carbon dioxide was to provide a warning gas.

This feature has been studied by Mr. R. M. Jones, Entomologist, Liquid Carbonic Corporation of Chicago, Illinois. It may be possible then, to incorporate sufficient carbon dioxide to provide the necessary warning just as chloropicrin is used with HCN gas.

NOTES ON THE LABORATORY REARING OF SOME CANADIAN TICKS (Acarina) *

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Many of the projects on ticks at the Dominion Entomological Laboratory at Kamloops are dependent, to a greater or lesser extent, on an accurate knowledge of the bionomics of these pests. This study is necessarily a lengthy one, since there are 3 or more stages of each of the 20 or so species involved, and each stage presents a problem of its own, involving a host, and a period of observation lasting for at least several months. As many ticks are highly resistant to unfavourable conditions and can withstand starvation for long periods, the accumulation of data complete with longevity observations, may involve several years' study. Frequently after a number of seasons have been spent in searching for an engorged fertile female of a certain species in order to establish a laboratory strain, progeny have died before a suitable host could be provided. Since knowledge of the host relationships and host specificity of even the more common species of ticks is still fragmentary, certain information relating to these problems gathered at the Kamloops laboratory may be useful.

One of the most important factors in the rearing of ticks is humidity. Although extremely resistant to insecticides, dips, and starvation, practically all Ixodidae require high atmospheric humidity. Species that can survive for a year or more under optimum conditions may desiccate overnight if subjected to normal room humidity. Ticks should be kept in a cool cellar in open-ended glass tubes over damp soil.

As a rule humidity is adequate while ticks are feeding on animals. Nevertheless it is advisable to keep the hosts in a reasonably humid atmosphere. Although this is particularly true for certain ticks from humid areas, it applies also in the dry Interior of British Columbia, for the early stages in the development of ticks are frequently passed either against the moist skin of the host, or in its damp burrows.

While at Kamloops all longevity tests are carried out in a tick cellar (T. 18° C., H. 100%), it has been determined that the best method for holding ticks beyond their normal life span is to store them at 5°C. in pill boxes in a sealed jar containing damp absorbent cotton. In the case of *Ixodes californicus* Banks, the combined periods of preoviposition and incubation normally require four months at 18°C. or two months at 21°C. but can be prolonged for over two years under these conditions.

During storage ticks must be kept free from condensed moisture, as they drown quite as readily as they desiccate. It is advisable to trim off the cotton plug of each vial, and slide it about a quarter of an inch into the tube, to avoid the possibility of water moving up from tray to tube by capillarity. Identification labels should be placed between plug and vial, for if left in the vial the writing soon becomes obliterated by excrement.

Dermacentor andersoni Stiles, the vec-

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